



Experimental Study of Dynamic and Electromagnetic Triggering Phenomena at the Spring-Block Facility

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Theoretical and field/laboratory experimental results obtained during implementation of research projects in Russia within recent ten years [1-2] show an evidence of artificial and natural electromagnetic triggering of earthquakes and implication of electromagnetic phenomena for earthquake preparation and occurrence. For practical application of gathered knowledge on electromagnetic triggering phenomena for earthquake prediction/control it is necessary to clear the mechanisms of electro-seismic processes resulted in earthquake occurrence and release of tectonic stresses in the seismo-active faults.

Two major hypotheses were proposed to explain the earthquake triggering due to injection of high-power electric pulses into the Earth crust: 1) increase of pore pressure in the fluid-saturated rocks due to Joule heating [3]; and 2) electrokinetic phenomena in the rocks resulted in rock fracturing [4]. For verification of the proposed hypotheses the spring-block facility was designed, which allows to study the fault gauge (granular media) behavior under external mechanical and electromagnetic triggering impacts [5].

Under controlled conditions (normal load, shear stress, horizontal loading rate, grain-size composition of gauge material, fault gauge thickness and moisture) the seismic cycle variations were studied under external triggering impacts at near-to-failure shear stress. Various modes of fault gauge behavior (stick-slip, creep, 'silent earthquake') were demonstrated. It was shown that under triggering impacts specific for field conditions only combination of mechanical and electromagnetic triggers may result in sudden slip of moving block (earthquake simulation) or modification of seismic cycle (transformation of stick-slip behavior to creep or series of prolonged slips - 'silent earthquakes'). Implications of obtained results for earthquake hazard mitigation are discussed from point of view of earthquake prediction based on triggering phenomena, as well as a possibility of partial release of tectonic stresses by artificial actions resulted in series of small slips instead of big one, creep, or 'silent earthquake'.

References:

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